L A C E, Incorporated
Research and Development of Wired and Wireless LOCAL AREA COMMUNICATION EQUIPMENT

July 24, 1995

Secretary
Federal Communications Commission
1919 M Street, NW
Washington, DC 20554

DOCKET FILE COPY ORIGINAL

RE: Rule Making RM-8648 and RM-8653
Reply Comments of Chandos A. Rypinski
Shared Unlicensed Radio Spectrum in the 5 Ghz band

Gentlepersons:

Attached hereto, are an original and 11 copies of my Reply Comments in the above stated matter.

It is requested that one copy be returned to me as an acknowledgement of receipt.

Cordially,

Chandos A. Rypinski

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of:	)	
	)	
Wireless Information Networks Forum	)	RM-8648
Petition for Rulemaking To Allocate the 5.1 - 5.35 GHz Band and Adopt Service Rules for a Shared Unlicensed Personal Radio Network	)	
	)	
Apple Computer, Inc. Petition for Rulemaking To Allocate Spectrum in the 5 GHz Band To Establish a Wireless Component of the National Information Infrastructure	)	RM-8653

DOCKET FILE COPY ORIGINAL

REPLY COMMENTS OF CHANDOS A. RYPINSKI
LACE, Inc.

dated: July 24, 1995

SUMMARY OF RECOMMENDATIONS

This respondent strongly supports the petitioners Apple, WINForum and others requesting allocation of 5 GHz band frequency space for wideband high functionality communication. It is urged that the FCC take steps to designate this space for that purpose at the earliest feasible date.

Exception is taken to suggestions that HIPERLAN is preferred technology for this spectrum because of insufficient functionality, These considerations are addressed in these comments.

In further proceeding, the FCC should define service characteristics for acceptable uses of the space so as to encourage continuing effort to develop appropriate technology.

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REPLY COMMENTS OF CHANDOS A. RYPINSKI
LACE, Inc.

dated: July 25, 1995

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In further proceeding, the FCC should define service characteristics for acceptable uses of the space so as to encourage continuing effort to develop appropriate technology. In particular, this band should be considered as the primary space for high bandwidth connection and packet services. As such, the acceptable technologies should be enabled on longer term considerations, and not immediate markets.

To expand capacity for immediate needs, the technical rules for the Part 15 ISM band at 5.7 GHz band should be expanded to permit transmission of other modulation/bandwidth tradeoffs to allow more unspread bandwidth for high-speed, short duration transmissions. The envelope of permitted modulations might well include the HIPERLAN air interface.

These comments address the criteria for more effective use of this spectrum. The problem be correctly defined before solutions are nominated and enabled rather than the reverse order.

OPTIMIZATION CRITERIA

Given that wideband 5 GHz is enabled for NII, the optimization criteria should be:

1) The service capability of one wireless-linked portable computer using only one infrastructure and air interface, should include both a) packet data and b) telecom extendable bandwidth-on-demand connections with competent delay and accuracy for each service.

2) The quality of service considering capacity, delay and accuracy should be competent not only in first year of permitted use, but also after millions of units of station equipment have been put into use.

3) Maximized commonality of system design and air interface for private systems on private premises and for the same services from service providers on public premises (e.g., airport terminal buildings).

Since no petitioner appears to have started with initial assumptions with this generality, these comments will briefly attempt to point out the reasons for this and the definitions of the problem that are necessary to secure the development of appropriate technology.

FRANCHISE

It is conceivable that the same services that are available from private systems will also be available on public premises from service providers whose franchise is the area of one premise unit. The area granularity of boundary definitions should be one radio coverage of about one acre. In one basic trading area, there may be large numbers of such franchises. This selectivity is necessary to enable owners of private premises to own their own infrastucture..

TECHNOLOGY AND PROTOCOL

High and low level considerations become intermingled when the solution is selected before the problem is defined. By selecting monitor-before-transmit access in the beginning, a large number of later decisions are preempted resulting in a flawed conclusion.

Integrated Connection and Packet Services (IS) and ATM Compatibility

An integrated services network is unlikely to be achieved by modifying or extending either existing telecom or internet facilities. Each will have great difficulties trying to emulate the other in addressing, delay and accuracy. Future bandwidth requirements are certain to be an order of magnitude greater for the high speed transfer of images and video whether that bandwidth is a connection or a series of packets.

A very large fraction of this traffic will be beyond the range of a single microwave radio link. That fraction will depend on infrastructure services of some sort to link separated radio coverages. The shorter the range of the endlink, the more significant the infrastructure backbone.

While the use of frame relay, dial-up voice, ISDN Basic Rate and various Internet protocols are now used for wide area backbones, none of these alone is sufficient for all types of communication. The only possibility now existing for *integrated packet and data services* via

wide area switched networks is Asynchronous Transfer Mode (ATM). The physical medium transport cell is identical for all services in ATM. The less different, the wireless interface, the easier the problem of IS interconnection of discrete wireless networks.

All of this can be put together so that the user station has the technical capability to communicate with any other station without regard to location. That communication can be of any type now in wide use including the packet services of wired LANs, the pocket telephones and future large scale services with images and video.

Managed Channel Alternative Advantage Over Distributed Logic

The known standards defined packet data networks, e.g., HIPERLAN and IEEE 802.11, have been designed as a single coverage area for a user cluster operating peer-to-peer. These *distributed logic* systems are said to be extendable to larger multiple coverage areas but they do not include a plan for interference-limited system design with many like type groups within a common radio range. They are usually without consideration of frequency reuse.

The initial assumptions of these system preclude design for maximized spectrum utilization which will lead to inadequate quality of service if large numbers of stations operate in proximity. The gap between is what will be and what should be obtained is ***one or two orders of magnitude*** (10 to 100 times). The alternative will be based on *centralized channel managers* in hub equipments common to many coverage areas. The result is simpler stations and inherent connectability to outside telecom and packet data networks.

The use of infrastructure and centralized control technology is an optimizing decision not the choice of a mandatory outside service provider. It is also does not preclude ad hoc groups. There is always service provider even if it is a Company function. Opting for centralized control is an economic and functional technical decision, not a business choice.

Analogy--Meetings with Voice Communication Between Humans (optional reading)

It may be helpful for non-technical individuals to consider some analogies using meetings between people fitting the two following descriptions:

Ad hoc meetings: anywhere and everywhere between small numbers of people within earshot of each other and frequently spontaneous

Organized meetings: defined time, place, participation with a chairman or other type of presiding manager.

Ad Hoc Meetings and Conversations

Ad hoc meetings depend on "etiquette" so that each participant takes a reasonable share of the bandwidth. Everyone present or in earshot is part of the meeting. Usually there is not "interference" from other nearby groups. When there is such interference the situation is different.

Many ad hoc meetings can occur in the same sound space. This is true at cocktail parties, hospital wards, trading floors and hotel lobbies. The common characteristic is a then a background level of interference from other talking people. The sound space is almost always active.. Conversation is possible only because the source and destination are closely spaced enabling sufficient signal-to-noise ratio. Humans have the capacity to ignore interfering signals that are not too strong based on identity discrimination. This quality is not duplicated in radio systems without a deliberate effort.

Organized Meetings

The relevant common characteristic of organized meeting is the Chairman who determines who has the floor. The channel bandwidth is used by one participant at a time. The Chairman frequently follows an access protocol known as "Robert's Rules of Order." This protocol has nothing whatever to do with the substance of the meeting. Participants who do not follow the

rules cause interference with reduces the capacity of the meeting to transact its business.

Sometimes, a meeting in a large room breaks into several smaller simultaneous meetings in the same room. There is then no interference barrier beyond space. Essentially communication is possible only when the interferer is spaced several times the distance between the subchair and the most distant participant in his group. Very often participants at the edge of a subgroup cannot follow the proceedings carried on by a core at the center.

Some meetings are fairly large like a commercial Company promoting its product. This largely done in broadcast mode with no access protocol, except during the question and answer session.

A common characteristic of such meetings in the amplified audio or sound reinforcement system. If the Chairman has a microphone and the audience doesn't, the Chairman must repeat each question. The questioner often makes a directional transmission toward the Chair and cannot be heard by a large part of the audience. In large meetings, the individuals cannot communicate with each other, but they all may be able to communicate with the Chair or head table for rebroadcast. The audio repeater increases the size of the group beyond earshot range..

The problem is more complex for a State caucus in a national presidential political convention. All sound communication is interference limited. It is imaginable to add to this pandemonium data communication between the podium and portable computers.

The Radio System Parallels

Certain large computer Companies have advocated ad hoc group using peer-to-peer communication as the primary model. For service to outside networks, access points are allowed, but a channel management function at the access points is at least minimized.

Advocates of peer-to-peer networking are attempting to say a meeting of large size can be held without a Chairman and Rules of Order enforced by the Chairman. When such a meeting is held, all stations have equal access to the channel whether such stations are resident or foreign. This approach to a wireless medium meeting seriously limits capacity and predictability of performance.

It is commonly assumed that the ad hoc meeting is in a room isolating the participants from all others using the communication space. In fact, the radio communication space for a continuous carpet of users over the premises area of a business is more like the cocktail party or convention floor. Most signals heard contribute to the interference, and they are from other surrounding groups. This is the context in which *large gains are possible for organized systems*. The net capacity is the radio spectrum bandwidth divided by the total number of users within a radio interference coverage area. This can reduce the capacity of one user cluster to a few percent of what it would be without interference.

The losses can be compounded by not using repeater mode communication where all stations talk to a common privileged antenna associated with the chairman function. Large scale peer-to-peer operation is at best inefficient and may be totally unworkable. Limiting the number of radio paths needed to a common point for each area is the only feasible method of providing service at microwave frequencies to stations with small transmitter and antennas.

COMMENTS ON ETSI RES10 HIPERLAN

There is much to commend about this system. The combination of modulation, forward error correction and adaptive equalization is well done. It is less clear that dividing the available spectrum into seven channels is a good choice. Since this organization normally produces results which have competent experimental verification, a lesson may be taken:

Adaptive equalization is a more spectrum efficient way of dealing with multipath time dispersion in the medium than direct sequence spreading.

Channelization

If the seven channels were the building block for a frequency reuse plan (not stated in present documents), it is at least a rational selection. If on the other hand it is a means to allow isolated operation of uncoordinated and independent systems to be randomly overlaid, it is a mistake.

For a channelized system to work as one system, there must be an associated infrastructure plan. It is quite possible that this "shoe will drop" at a later date. One key property of such a plan is the "handoff" function (or equivalent alternatives). Another is continuity of access. There must be means to reach a roaming user station regardless of the access point currently in use for coverage.

Continuous access is equally needed for packets and connections, however packet protocols for finding stations with broadcasts are a waste of channel time, and more importantly contribute to delay buildup. The current location of stations and their status is information that should be in a common data base used by channel managers to direct transmissions only to the appropriate access point avoiding futile use of channel time.

Absence of Defined Channel Manager Function

The largest weakness in HIPERLAN is the dependence on clear channel observations to enable transmission. Instead, there should be a channel manager per coverage and a manager of channels as a group. Such a function is not now defined.

In the absence of such a function, it is not possible to reserve future (4-24 milliseconds) capacity for connection type services. Without this function, there is no predictability of timely delivery of the bursts into which the connection path information has been divided. This function is desirable but not necessary for packets.

The main attraction of this mode or operation is that is compatible with broadcast functions not only from servers but from individual stations. The characteristics of these systems on wire is well known as are phenomena like "broadcast storms." With a channel manager, a station must request a broadcast service from the manager including a non-infinite list of addressees. Broadcasts with a scope of one access point or several of the access points sharing a common hub remain possible with a channel manager.

Manager of Channel Managers

The use of one access point is somewhat conditional depending on the status of others which may be mutually exclusive generally, but which can be used selectively when traffic peaks do not occur at all places at the same time. The manager of channel managers deals in functions for which contiguous access points are interdependent.

A further example function is the use of successfully received transmissions only on an unexpected access point as may happen with temporary obstacles (persons walking by the station). A functionality common to all access points must determine the usefulness of such messages. This is a function that has no equivalent in wire.

This function is undefined in HIPERLAN, but it may be essential to effective use of the NII band for enterprise wide networking.

CONCLUSION AND COMMENTS

It is premature for a regulatory bias favoring either single bandwidth connection or broadcast mode packet data. What is needed is a single wireless infrastructure for both services. This is possible if it is based on ATM switched backbones and minimal differences in endlinks. No regulatory recognition of any particular technology should be given until this goal is achievable.

This respondent has heard presentations asserting that HIPERLAN is ATM compatible, but this conclusion does not seem reasonable. There is little doubt that the cells can be transmitted, however the mechanisms are not visible which would assure timely delivery of those associated with connection type services. In addition, without central time-use managers, the plan is throwing bandwidth at a problem that is better solved with management and organization.

There is much discussion of the benefits of common technology for both European and North American data communications equipment. The economic advantage is undeniable for manufacturers participating in both markets. Nonetheless such an agreement on an insufficient system will not make it (magically) adequate nor will the market be large.

It is hard for this respondent to see the benefit of using his portable computer with same air interface in both Europe and North America when there is no possibility of using it in North American airports for external network access.

The ad hoc services are necessary and useful, but they are a small fraction of the general use. In particular, University students talk very little with each other when compared with their traffic generated by data base searches and the various forms of archived information. The

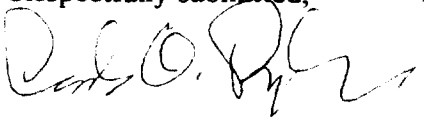
students do interact with the faculty, but this is not ad hoc even if ad hoc technology would appear usable. To these and many others, the efficiency and speed of out-of-network services is the primary use for which a system design should be optimized. The ad hoc peer-to-peer is a permitted minor subset of the overall function.

Note that the IBM offered an access method to IEEE 802.11 which included a time interval allocated for peer-to-peer use within an overall frame structure of an infrastructure managed plan. It is believed that the present wireless LAN product incorporates or allows this feature. What is not acceptable is allowing spontaneous transmissions for ad hoc groups in an area where the channel time is managed.

Notwithstanding, these somewhat negative comments, the goals of high bandwidth allocations for developing multi-media services are absolutely correct and must be pursued. The most powerful seed is allocation of bandwidth for the service. This is what happened that got "cellular" on the road following the report of the ACLMRS (1968).

The development and choice of technologies should for the present be a continuing public discussion or market competition in the new band or in the 5.7 GHz ISM band.

Respectfully submitted,



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